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SEA-LEVEL RISE ADAPTATION POLICY IN VARIOUS STATES

By: Kristen L. Miller, Legislative Analyst II
Janet L. Kaminski Leduc, Senior Legislative Attorney
Kevin E. McCarthy, Principal Analyst

You asked two questions related to sea-level rise adaptation policy in ten states (Florida, Louisiana, Maryland, Massachusetts, New Jersey, New York, North Carolina, Rhode Island, South Carolina, and Virginia). The questions are:

1. Does state law or regulation require policymakers or planners to take sea-level rise into account in the policies they create for land use planning or development?
2. Does the state have a designated office or unit responsible for coordinating sea-level rise adaptation planning across state agencies?

SUMMARY

The answers to the above questions vary by state. Two states have specific laws or regulations that require policymakers or planners to consider sea-level rise when creating policy for land use planning or development (Massachusetts, Rhode Island). Others have related laws or regulations, such as requiring the consideration of sea-level rise when reviewing certain permit applications (Florida, Maryland). Most, however, do not have such statutory or regulatory requirements (Louisiana, New Jersey, New York, North Carolina, South Carolina, Virginia), but may consider sea-level rise by other methods or in practice.

Half of the states have a designated office or unit responsible for coordinating sea-level rise adaptation planning across state agencies (Maryland, Massachusetts, New Jersey, New York, Rhode Island). States that do not have such an office or unit are Florida, Louisiana, North Carolina, South Carolina, and Virginia.

Other efforts undertaken by these states to address sea-level rise, such as conducting studies, developing statewide plans, and providing assistance to local governments, are briefly discussed below.

INTRODUCTION

Historical Sea Level Increases

According to the National Oceanic and Atmospheric Administration (NOAA), the average global sea level has been rising at an average rate of 1.7 mm/year (less than an eighth of an inch) over the past 100 years, which is significantly larger than the rate averaged over the last several thousand years. The increase has been accelerating in recent years. NOAA has used satellite-based altimeters to estimate that global sea level has risen at 3.2 mm/year (slightly over an eighth of an inch) since 1992. Coastal tide gauge measurements confirm this observation (<http://www.ncdc.noaa.gov/cmb-faq/globalwarming.html>).

Sea level change also varies geographically. A 2012 study by U.S. Geological Survey oceanographers analyzed tide gauge records from 1950 to 2009. They found that the rates of sea-level rise along most of the northern half of the eastern seaboard (from Cape Hatteras, North Carolina to Boston, Massachusetts) are increasing three to four times faster than rates of sea-level rise globally.

Two main factors affect the level of water in the oceans: the amount of water and the temperature. Sea level rises when water is added, for instance, from melting glaciers, and also when the oceans warm. Nearly 90% of the excess heat added to the earth since the 1960s has been stored in oceans (<http://scrippsnews.ucsd.edu/Releases/?releaseID=1258>). Warmer water has a larger volume than cooler water, as a result of thermal expansion (<http://www.climatewatch.noaa.gov/article/2012/2011-state-of-the-climate-sea-level>). While much of the debate on climate change has focused on air temperatures, ocean temperatures have also been rising. For example, data collected by environmental scientists at Millstone nuclear power plant in Waterford, Connecticut show average

temperatures of the waters around the plant have risen by 0.67 degrees Fahrenheit per decade since 1976 (<http://www.theday.com/article/20120817/NWS01/308179952/1018>).

Projected Increases

In 2007, the Intergovernmental Panel on Climate Change (IPCC) projected that by the end of this century, global sea level will rise another 18 to 59 centimeters (7.1 to 23.2 inches), depending on future greenhouse gas emission levels. This increase is due mainly to thermal expansion and contributions from melting alpine glaciers, and does not include any potential contributions from melting ice sheets in Greenland or Antarctica (<http://www.ncdc.noaa.gov/cmb-faq/globalwarming.html>). A literature assessment published in 2010 by the U.S. National Research Council described the IPCC projections as "conservative" and summarized the results of more recent studies. These studies projected increases of 56 to 200 centimeters (22 to 78.7 inches) by the end of this century.

A 2011 [study](#) projected a sea-level rise of 32 centimeters (12.6 inches) by 2050. This projection included increased contributions from the Antarctic and Greenland ice sheets. The authors concluded that if current melting trends continue, ice sheets will be the dominant contributor to sea-level rise in this century. Another 2011 [study](#) confirmed this projection using two different analytic approaches.

Impacts of Rising Sea Levels

As NOAA notes, even a small vertical rise can result in seawater covering large areas of flat beaches and low-lying land. If sea level rises quickly, the encroaching ocean can drown coastal marshes and disrupt seaside ecosystems. Higher seas also enable storm surges to travel farther inland, putting more lives in danger and increasing the risk to property when powerful storms come ashore. People living in lowland areas may have to decide whether they should raise the elevation of their homes, build protective barriers such as levees or seawalls, or move inland. Higher sea levels may also submerge docks, decrease the clearance available for ships to pass under bridges, and threaten vital sources of fresh water along coasts. For more information, see <http://www.climatewatch.noaa.gov/article/2009/climate-change-sea-level>.

A 2010 Columbia University [study](#) of the New York City metropolitan area found that the projected sea-level rise will likely triple the frequency of coastal flooding there. The study, which included Connecticut's Fairfield, Litchfield, and New Haven counties as well as the rest of the New York region, found that many transportation system components (e.g., road and railroad segments and airport runways) are at elevations of 6 to 20 feet above current sea level, exposing them to storm surges that may reach heights above 20 feet. Two-thirds of the facilities in the region have components that are at or below 10 feet above current sea level and would be subject to flooding at least once every decade by the end of the century, with some facilities subject to flooding every few years.

INITIATIVES IN SELECT STATES

Florida

There is no designated office or unit responsible for coordinating sea-level rise adaptation planning across agencies, according to Ann Lazar of Florida's Coastal Management Program (CMP) in the state's Department of Environmental Protection (DEP).

However, Florida law requires all local governments to create, adopt, and maintain long-range comprehensive plans to guide growth and development ([F.S.A. § 163.3167](#)). In 2011, the Florida legislature passed the Community Planning Act, which made changes to the state's growth management laws, including allowing local governments the option to designate areas that experience coastal flooding and are susceptible to sea-level rise as "adaptation action areas." The designation prioritizes funding for infrastructure and adaptation planning. Local governments that adopt an adaptation action area may consider management policies to improve flooding resilience from hazards such as storm surge, flash floods, and sea-level rise, among others ([F.S.A. §§ 163.3164 and 163.3177\(5\)\(g\)](#)).

In 2012, the state's Department of Economic Opportunity began a five-year project to examine statewide planning and determine how to incorporate sea-level rise adaptation into planning mechanisms and coordinate sea-level rise adaptation efforts statewide (the [Community Resiliency Initiative](#)). The project will involve (1) an inventory of sea-level rise research in other states and identifying technical assistance resources available for community planning and adaptation and (2) pilot adaptation planning projects using a model for sea-level rise and best practices guidance for adaptation planning.

Coastal Partnership Initiative grants are also available through CMP to promote protecting and effectively managing Florida's coastal resources at the local level. Grant applicants must meet at least one purpose of certain priority areas, such as helping communities prepare for and respond to the effects of climate change and natural hazard events. An eligible project could include developing climate change adaptation strategies ([Fla. Admin. Code 62S-4.004](#)).

The DEP is responsible for issuing state coastal armoring (e.g., seawalls) permits, and state regulations require it to consider coastline geomorphology and active coastal processes, such as historic erosion rates and sea-level rise, when reviewing these permit applications ([Fla. Admin Code. 62-B-41.005](#)).

Through the state's conservation and recreation lands acquisition program, [Florida Forever](#), the DEP's Acquisition and Restoration Council is responsible for creating a priority list of lands for state preservation. When developing the priority list, the council must consider lands that help address global climate change by providing opportunity to mitigate and help adapt to sea-level rise effects, among other things ([F.S.A. § 259.105](#); [Fla. Admin. Code 18-24.006](#)).

Louisiana

After the 2005 hurricane season, the Louisiana legislature restructured the state's Wetland Conservation and Restoration Authority to create the [Coastal Protection and Restoration Authority](#) (CPRA) within the office of the governor. Among other things, it required CPRA to develop and implement comprehensive coastal protection plans, including the state's master plan, which is revised every five years, and annual plans.

CPRA developed its [first master plan](#) in 2007 to direct protection and restoration efforts and it was unanimously approved by the legislature. In 2008, Governor Bobby Jindal issued an executive order requiring all state agencies to administer their regulatory practices, programs, contracts, grants, and other functions in a way that is consistent with the state's master plan, if possible ([Exec. Order No. BJ 2008-7](#)). The [2012 master plan](#) (Louisiana's Comprehensive Master Plan for a Sustainable Coast) was approved unanimously by the legislature. This plan guides the state's coastal investments for the next 50 years and provides a long-term solution for coastal protection and restoration. Sea-level rise was one factor in the analysis of which potential plan projects should be included in the plan. The plan also notes that newer sea-level rise projections will be factored into future project planning and design.

According to James Pahl, of CPRA's Strategic Planning Section, state law has no requirement for considering sea-level rise in project planning and design. However, CPRA's projects account for sea-level rise as a matter of practice because of the significant rate of sea-level rise due to subsidence (downward land shift). As explained in a 2009 [article](#) published in the Journal of Coastal Research, Louisiana's coastal subsidence is the result of both natural processes and human activity, such as withdrawing groundwater and petroleum. Further, Torbjörn Törnqvist, a coastal geoscientist at Tulane University, has [explained](#) that man-made levees, river diversions, and oil drilling along the coast have contributed to sinking marshland at a rate that causes the Louisiana Delta to lose land area about the size of a football field in less than an hour.

Pahl reported that considering sea-level rise is new for some projects and more important due to switching to a more standard 50-year project lifespan or analysis period.

How best to account for sea-level rise is a decision essentially left to each agency to determine, according to Pahl. CPRA recently developed a guidance document for its staff on sea-level rise that will soon be available in its [online document library](#).

Maryland

In 2007, Maryland's Governor Martin O'Malley issued an executive order establishing a Climate Change Commission to advise the governor and legislature on matters related to climate change ([Exec. Order No. 01.01.2007.07](#)). The Order required the commission to divide into three working groups: (1) Scientific and Technical Working Group, (2) Greenhouse Gas and Carbon Mitigation Working Group, and (3) Adaptation and Response Working Group (ARWG).

The ARWG was charged with developing a comprehensive strategy to reduce Maryland's climate change vulnerability. This strategy had to outline specific policy recommendations for reducing the vulnerability of the state's natural and cultural resources and communities to the impacts of climate change, with an initial focus on sea-level rise and coastal hazards, including shore erosion and coastal flooding. In August 2008, the ARWG released Maryland's [adaptation strategy](#) for sea-level rise and coastal storms laying out short- and long-term adaptation and response measures.

The following were among AWRG's key recommendations:

1. require the integration of coastal erosion, coastal storm, and sea-level rise adaptation and response planning strategies into existing state and local policies and programs;
2. develop and implement state and local adaptation policies (i.e., protect, retreat, abandon) for vulnerable public and private sector infrastructure;
3. strengthen building codes and construction techniques for new infrastructure and buildings in vulnerable coastal areas; and
4. promote and support sustainable shoreline and buffer area management practices.

Also in 2008, Maryland's legislature enacted the [Living Shoreline Protection Act](#), which requires that improvements made to protect a person's property from shoreline erosion use living shoreline or non-structural shore protection practices wherever technologically and ecologically appropriate. Living shorelines provide erosion control benefits while also enhancing the natural shoreline habitat. They often allow for natural coastal processes to remain through the strategic placement of plants, stone, sand fill, and other structural and organic materials. Under the act, a person may receive a waiver from the Maryland Department of the Environment if he or she can demonstrate that nonstructural measures are not feasible for his or her property (http://mlis.state.md.us/2008rs/chapters_noln/Ch_304_hb0973E.pdf).

Maryland regulations require the department, when evaluating a tidal wetlands license or permit application, to consider, among other things, the degree to which "danger may arise because of the location of proposed structures from hurricanes, floods, sea-level rise, or other determinable and periodically recurring natural hazards" (Md. Regs. Code § 26.24.02.03).

Maryland's Department of Natural Resources (DNR) has the lead role among the state's agencies in advancing the scientific understanding of Maryland's vulnerability to climate change, and in advocating for sound planning to avoid or minimize the anticipated impacts. Within DNR, the Office for a Sustainable Future (OSF) facilitates and assists the department in developing and implementing sustainable practices, as well as coordinating with other state agencies. Zoe Johnson, OSF's Program Manager for Climate Change Policy, is the coordinator for sea-level rise adaptation across state agencies (see <http://dnr.maryland.gov/sustainability/contact.asp> and <http://dnr.maryland.gov/climatechange/>).

Massachusetts

Massachusetts' regulations require that new buildings within a flood zone intended for human occupancy and not intended for water-dependent uses be designed and built to incorporate projected sea-level rise during the buildings' design life, in a manner consistent with projected sea-level rise. Such projections must be based on historical rates of sea level increase in New England coastal areas ([310 CMR 9.37\(2\)\(b\)\(2\)](#)).

The Office of Coastal Zone Management (CZM) is in the Executive Office of Energy and Environmental Affairs (EEA) and is responsible for coordinating the state's response to sea-level rise. In 2008, Massachusetts enacted the [Global Warming Solutions Act](#) which, among other things, directed the EEA secretary to convene an advisory committee to develop a report, analyzing strategies for adapting to predicted climate changes. The report's final [chapter](#) addresses coastal and ocean issues, primarily sea-level rise.

The report notes that in 2008 CZM launched its [StormSmart Coasts program](#) to help coastal communities address sea-level rise and other climate-related challenges. CZM developed tools such as fact sheets, case studies, smart growth planning strategies, legal and regulatory tools, and extensive technical materials. The program implements the [Coastal Hazards Commission](#) recommendation to establish a storm-resilient communities program to provide case studies for effective coastal smart growth planning and implementation. CZM has also (1) held regional workshops to directly connect local officials with the program and (2) began pilot projects in certain towns and regions to test local implementation of StormSmart Coasts' tools. Further information about these initiatives is available at www.mass.gov/czm/stormsmart.

New Jersey

New Jersey does not have a law or regulation that requires policymakers to consider sea-level rise projections in land use planning, according to Martin Rosen, Manager for the Coastal Management Program (CMP) within the New Jersey Department of Environmental Protection.

According to Rosen, the state previously maintained an Office of Climate and Energy (OCE), which is now defunct. The Office of Sustainability and Green Energy (SAGE) absorbed OCE's staff and functions and is now responsible for climate-related policy development

and implementation. While adaptation is part of SAGE's charge, SAGE coordinates any sea-level rise adaptation efforts with CMP (<http://www.nj.gov/dep/sage/climate-energy.html>).

New York

In 2007, the New York legislature created the [State Sea Level Rise Task Force](#) (2007 N.Y. Laws ch. 613) and directed it to develop recommendations for adapting to sea-level rise. The task force was composed of staff from state agencies, local governments, not-for-profit groups, and private citizens appointed by members of the legislature. The Department of Environmental Conservation (DEC) commissioner served as the task force's chair.

The task force delivered its report to the legislature on December 31, 2010. The report found that harbor tide gauges had shown a rise of 4 to 6 inches since 1960 and that the sea level was 15 inches higher in New York Harbor than 150 years ago. The report also projected that sea-level rise will accelerate for the foreseeable future and every New York community along the marine coast (approximately 62% of the state's population) will be affected.

The report adopted the sea-level rise projections in the table below for two of the most affected regions of the state. These projections have not been officially adopted by the legislature and no law or regulation requires policy makers to consider them in land use planning. However, DEC considers them the best available projections for planning purposes.

Table 1: Projected Sea Level Rise in Two Regions of New York

Lower Hudson Valley & Long Island	2020s	2050s	2080s
Sea-level rise	2 to 5 in	7 to 12 in	12 to 23 in
Sea-level rise under rapid ice-melt scenario	5 to 10 in	19 to 29 in	41 to 55 in
Mid-Hudson Valley & Capital Region	2020s	2050s	2080s
Sea-level rise	1 to 4 in	5 to 9 in	8 to 18 in
Sea-level rise under rapid ice-melt scenario	4 to 9 in	17 to 26 in	37 to 50 in

DEC is the lead agency for coordinating adaptation planning initiatives. It is working with an ad hoc interagency group to identify ways to address sea-level rise within the agencies' existing regulatory authority. One of the participating agencies, the N.Y. Department of State, has developed a draft guidance document to increase the resilience of coastal communities. The department's [website](#) has links to adaptation programs in the state and possible funding sources for them.

North Carolina

North Carolina does not have a law or regulation that requires policymakers to take sea-level rise projections into account in land use planning, according to Tancred Miller from North Carolina's Division of Coastal Management (DCM) in its Department of Environment and Natural Resources. Similarly, the state has no designated agency responsible for coordinating sea-level rise adaptation planning across state agencies.

In 2012, North Carolina enacted a law ([HB 819](#)) that, among other things, established a process to define rates of sea-level change for regulatory purposes. Specifically, the law prevents the state from defining sea-level change rates until 2016, but it allows local governments to do so. It specifies that the Coastal Resources Commission (CRC) is the only state agency allowed to define such rates and that it must do so in conjunction with DCM. The law also requires CRC to direct its Science Panel to update its [2010 report](#) (see below) to review scientific literature on sea-level change including "sea-level fall, no movement in sea level, deceleration of sea-level rise, and acceleration of sea-level rise." CRC must study the coastal economic and environmental costs and benefits of sea-level regulations and policies.

Under current regulations, each county in the coastal area must have a land use plan that meets CRC planning requirements. Certain types of plans must include a future land use component, including the goal of conserving and maintaining natural hazard areas, such as areas subject to sea-level rise ([15A NCAC 07B.0701 and 07B.0702](#)). CRC establishes policies for the state's Coastal Management Program (CMP) and adopts implementing rules for the state's Coastal Area Management Act (CAMA) and Dredge and Fill Act. (DCM provides staffing for CRC, implements CRC rules, and issues CAMA permits.)

The CRC Science Panel on Coastal Hazards prepared a [North Carolina Sea-Level Rise Assessment Report](#) in March 2010 on the state of sea-level rise. The report's purpose was to provide planners and policymakers with a scientific assessment of the amount of sea-level rise likely to occur in the next century. Among other things, the panel recommended that a three foot rise in sea level be adopted as the amount of expected rise by 2100 for policy development and planning purposes. CRC is currently inviting public comment on a [draft sea-level rise policy statement](#) which states that global sea-level rise is occurring as a natural hazard and is predicted to continue. According to the draft policy statement, its goal is to provide a framework for "planned adaptation and improved resilience to rising sea levels."

As explained on DCM's sea-level rise [homepage](#), CRC and DCM have developed a six-part framework for evaluating and preparing for the risks from sea-level rise. Completing a scoping survey and the CRC's Science Panel's assessment report, in 2009 and 2010 respectively, were the first two steps. DCM states that the steps remaining to be taken are: (1) policy development, (2) recommendations for adaptation and building resilience to the Executive Branch, (3) amendments to CMP regulations and land use planning guidelines, and (4) coordination with state agencies and local governments.

The [North Carolina Climate Change Action Plan Advisory Group](#) and the [Legislative Commission on Global Climate Change](#) both released final reports (in 2008 and 2010, respectively) recommending, among other things, that the state develop a comprehensive climate change adaptation plan.

Rhode Island

Rhode Island's Coastal Resource Management Council (CRMC) is responsible for coordinating the state's response to sea-level rise. It has adopted regulations under which it will review its policies, plans, and regulations to plan for and adapt to climate change and sea-level rise ([Rhode Island Coastal Resources Management Program § 145](#)). CRMC will integrate climate change and sea-level rise scenarios into its operations to prepare the state for these new, evolving conditions and make its coastal areas more resilient.

CRMC's sea-level rise policies are based on its mandate to preserve, protect, and where possible, restore the state's coastal resources through comprehensive and coordinated long-range planning. It administers the state's Coastal Zone Management Act, and has land use powers in the area immediately adjacent to the coast.

CRMC recognizes that sea-level rise is ongoing and its foremost concern is the accelerated rate of rise and associated risks to coastal areas. Accordingly, for planning and management purposes, it is the council's policy to accommodate a base rate of a 3 to 5 foot rise in sea level by 2100 in the siting, design, and implementation of public and private coastal activities and to ensure proactive stewardship of coastal ecosystems under these changing conditions. The council notes that the assumed 3 to 5 foot rate of sea-level rise embedded in its policy is relatively narrow and low. Therefore, its policies may take into account different risk tolerances for differing types of public and private coastal activities. It will also periodically revisit sea-level rise projections to address new scientific evidence.

In 2006, Rhode Island's Building Code Commission amended the building code to consider the impacts of sea-level rise when developing new regulations. The commission later required all new development in certain coastal zones to be built one foot above base flood elevation.

Also, the state amended its comprehensive planning law in 2011 to require that municipalities consider natural hazards, such as flooding and sea-level rise. Municipalities must amend their local comprehensive plans by 2016 to reflect this change. The Division of Planning in the Department of Administrative Services is responsible for coordinating the actions of state, local, and federal agencies and private individuals within the framework of the state's comprehensive plan.

South Carolina

According to Barbara Neale of the South Carolina Department of Health and Environmental Control's Office of Ocean and Coastal Resource Management (DHEC-OCRM), the state does not have a specific law or regulation that requires policymakers to take sea-level rise projections into account in land use planning, nor does it designate an agency responsible for coordinating sea-level rise adaptation planning across state agencies. But state regulations identify sea-level rise as a cause of erosion problems and state that sea-level rise will require people who built too close to the beach to retreat ([S.C. Code § 30-1](#)).

Also, in recent years South Carolina has established several committees to study shoreline conditions and make shoreline management recommendations. For example, in 2007 DHEC-OCRM began a [Shoreline Initiative](#) to help address shoreline changes caused by sea-level rise, development, and storms. It required a [Shoreline Change Advisory Committee](#) to analyze risks to coastal communities, examine

current policies, and develop new methods for regulators, planners, and local governments to adapt to shoreline changes. The committee issued a [report](#) in 2010 that included many recommendations for shoreline management which considered such factors as sea-level rise, among other things. DHEC then selected members of a [Blue Ribbon Committee on Shoreline Management](#) to consider the Shoreline Change Advisory Committee's recommendations and develop and prioritize further recommendations for specific statutory, regulatory, and policy changes for shoreline management in the coastal area.

Virginia

No Virginia law or regulation requires policymakers to take sea-level rise projections into account in land use planning, according to Laura McKay, Program Manager for the Coastal Zone Management (CZM) Program within the Virginia Department of Environmental Quality.

However, in 2012 the legislature passed a resolution directing the Virginia Institute of Marine Science to study adaptation strategies to prevent recurrent flooding ([House Joint Resolution No. 50](#) and [Senate Joint Resolution No. 76](#)). Included in the legislature's findings are (1) sea-level rise has been identified as a threat to coastal Virginia and relative sea level at Sewells Point in Norfolk has risen by 14.5 inches since 1930 and (2) scientists predict an additional 2.3 to 5.2 inches of relative sea-level rise in the Chesapeake Bay region by 2100. The institute must submit its findings and recommendations to the legislature by the start of the 2013 regular session.

No specific state agency office has been designated to coordinate sea-level rise adaptation planning across state agencies, according to McKay. But CZM has coordinated and funded several coastal planning district commissions' projects that are assessing and mapping the potential impacts of sea-level rise

(<http://www.deq.virginia.gov/Programs/CoastalZoneManagement/CZMIssuesInitiatives/ClimateChange.aspx>).

RELATED OLR REPORTS: COASTLINE AND SEAWALL CONSTRUCTION

For more information about shoreline construction restrictions, see OLR Reports [2012-R-0046](#) (Coastline Construction Restrictions) and [2012-R-0074](#) (Seawall Construction Laws in East Coast States). These reports provide further information about restrictions on building homes or other structures, including seawalls, in coastline areas in many of the states discussed in this report.

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